



# UNITED STATES NAVY

## *Medical News Letter*

Vol. 51

Friday, 19 January 1968

No. 2

### Surgeons General of the Past (The twenty-seventh in a series of brief biographies)

Edward Christopher Kenney was born in Corning, Ohio, 19 February 1904, graduated from Denison University in 1926 and from the University of Cincinnati College of Medicine in 1929. He was appointed Assistant Surgeon with the rank of Lieutenant (jg) 4 June 1929. He served at many naval stations ashore and afloat, on battleships, destroyers, at naval hospitals and with the Marines. He was aboard the USS BOISE in the Battle of Cape Esperance off Guadalcanal 11-12 October 1942 and was awarded the Navy Cross for "extraordinary heroism" as Senior Medical Officer during action against enemy Japanese. He participated in penicillin research at the Long Beach Hospital, this being the first Pacific Coast hospital to use penicillin in the early days of its clinical investigation. Doctor Kenney was Staff Medical Officer with Amphibious Group Three of the Pacific Fleet during landings on Guam, Leyte and Lingayen Gulf, and in 1945 was Executive Officer of Fleet Hospital 114 at Samar in the Philippines. In 1950 he was a Fellow in Internal Medicine at the Mayo Foundation, and later Chief of Medicine at Camp Lejeune and Philadelphia. He became Commanding Officer of the naval hospital at Jacksonville and also at Bethesda, and commanded the National Naval Medical Center. In March 1958 Rear Admiral Kenney became Assistant Chief of the Bureau for Personnel and Professional Operations, and a year later Deputy and Assistant Chief of the Bureau, being appointed Surgeon General of the Navy 31 January 1961 for a 4 year term. During his term of office Admiral Kenney promoted advances in medical research and varied aspects of submarine, aviation and preventive medicine to help prepare the Navy's Medical Department for future contingencies. He was retired from the Navy on 26 February 1965.



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MEDICAL NEWS LETTER

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The issuance of this publication approved by the Secretary of the Navy on 4 May 1964.

## THE ACUTE SURGICAL ABDOMEN IN CHILDREN\*

Thomas M. Holder MD,<sup>†</sup> and Lucian L. Leape MD,<sup>‡</sup> Kansas City, Kansas, *New Eng J Med* 277(17):921-923, October 26, 1967. "Reproduced with the permission of the New England Journal of Medicine. Copyright 1967 by the Massachusetts Medical Society."

A few of the more common surgical conditions occurring in childhood that require prompt therapy will be reviewed in the light of current knowledge. For the purpose of this discussion, the acute surgical abdomen is defined as those conditions requiring prompt abdominal operation. These may be conveniently grouped into four major classes: diseases in which the predominating complaint is abdominal pain; the various forms of intestinal obstruction; gastrointestinal bleeding; and trauma.

### Abdominal Pain

Less than 10 percent of children coming to medical attention because of abdominal pain will require an operation. Within this group, however, are almost all those with a serious, life-threatening problem.

*The most frequent cause of misdiagnosis is failure to obtain a satisfactory abdominal examination.* In the irritable or uncooperative child, sedatives (not narcotics) are of inestimable value in providing a satisfactory examination. They usually must be given in doses sufficient to produce sleep. Chloral hydrate, administered by rectum, is a safe and effective drug.

### Appendicitis

Even today, 18 to 45 percent of children with appendicitis have a ruptured appendix by the time of operation. Virtually all the deaths (223 in 1964 in the United States) occur in the group with a ruptured appendix. Parental delay in seeking aid is a major factor in the frequency of ruptured appendix.

Physician delay, on the other hand, is usually

related to the difficulty in diagnosis. In children with almost all sorts of infection the same general symptoms may be present—irritability, vomiting, fever and frequently abdominal pain. Most of these do not produce well localized tenderness, however, and a thorough history and physical examination will usually differentiate them from appendicitis.

The triad of abdominal pain, fever and localized abdominal tenderness should be considered appendicitis until proved otherwise. Frequently, the clinical picture is atypical. The white-cell count may not be elevated; there may be evidence of a subsiding infection of the upper respiratory tract. If there is persistent localized abdominal tenderness, however, or generalized abdominal signs, appendectomy should be strongly considered. Rectal examination should never be omitted in the evaluation of abdominal symptoms.

Roentgenograms of the abdomen may be helpful if signs are equivocal. Two thirds of the children with a ruptured appendix and spreading peritonitis have a fecalith either in the appendix or in the free peritoneal cavity, though only a few fecaliths are radiopaque. If initial findings are inconclusive, the child should be seen again in three or four hours. If appendicitis cannot be excluded beyond reasonable doubt at that time, appendectomy is indicated. Operation is the conservative approach and carries very little risk in the patient with a nonruptured appendix. There is no place for the treatment of appendicitis with antibiotics if facilities are available for adequate surgical care. A figure of 20 percent negative explorations for appendicitis is not excessive.

Patients with ruptured appendix require particular attention to preoperative preparations, including rehydration, sedation and antibiotics. Fever should be controlled with a cooling blanket, if necessary, before operation. Significant improvement results with rehydration alone. Because of the

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child's small omentum and limited ability to localize intraperitoneal sepsis, waiting for localization of infection is unwise.

If appendicitis is not present at laparotomy, the ileum should be inspected for Meckel's diverticulum or regional enteritis. The pelvic contents should be palpated for torsion of an ovarian cyst or tumor. If Meckel's diverticulum is present, it should be removed. Resection of the involved segment in regional enteritis should not be performed unless there is perforation, fistula or obstruction. If the appendix is not involved in the inflammatory process, it should be removed so that subsequent abdominal pain will not be confused with appendicitis. There is some disagreement with this point of view, but there is little evidence that fistulas develop from the appendiceal stump if the base is not grossly involved.

Torsion of an ovarian cyst usually has a more sudden onset than appendicitis and is not as apt to be associated with vomiting. A mass is frequently present on rectal examination. The cyst should be removed. Oophorectomy should be performed for ovarian teratomas or other neoplasms. The opposite ovary should not be removed unless it is similarly involved.

#### Intussusception

The history of the sudden onset of episodic abdominal pain causing drawing up of the legs in a healthy infant between the ages of two months and two years should raise the question of intussusception. The additional findings of a mass in the upper abdomen and blood in the stool are diagnostic. Here, too, sedation may be necessary for an adequate abdominal examination. Unfortunately, a number of cases in infants do not conform to this pattern, and intussusception can be completely painless and present as predominantly intestinal obstruction or rectal bleeding. One should not hesitate to do an emergency barium-enema study for diagnosis on any infant in whom there is a question of intussusception.

Current interest centers around two aspects of this disease: etiology; and barium-enema reduction. In almost all infants the cause is not apparent, no tumor or other leading point being found at operation. Gardner et al. have recovered adenovirus from the feces in 46 percent of patients with intussusception as compared to 3.7 percent in controls.

An interesting group of patients are those in

whom small-bowel intussusception develops in the immediate period after an abdominal procedure. The cause is not clear but is probably related to disturbances in intestinal motility.

Barium-enema reduction is a safe form of therapy if the following criteria are observed: the surgeon should see the patient before any attempt at reduction; the usual preoperative preparations are carried out—specifically, institution of intravenous fluid therapy and nasogastric suction; the hydrostatic pressure is not to exceed 3½ feet; no manipulation of the abdomen is attempted (this further increases the intraluminal pressure and risk of bowel rupture); reduction is not considered successful unless there is free reflux of barium into the ileum—if the ileum does not fill freely, operation is required at once; the patient is admitted to the hospital for twenty-four hours of observation, and if symptoms persist, operation is mandatory; and reduction by barium enema is not attempted in the infant with x-ray evidence of marked intestinal obstruction, acute toxicity or clinical signs of strangulated bowel.

Barium-enema reduction has the limitations that it is of no value in the patient with small-bowel intussusception and usually does not detect any leading point as the cause of the intussusception. The major dangers of barium-enema reduction stem from the very factors that make it an appealing form of therapy—its ease and simplicity. The perforations and deaths that have occurred with its use have been in the hands of enthusiasts who have extended the indications or ignored the precautions stated above.

For patients with intussusception who are not candidates for hydrostatic reduction, or in whom it is unsuccessful, operation is performed as soon as adequate preparation has been carried out. Some surgeons consider this the safest form of therapy for all patients.

#### Intestinal Obstruction

After the neonatal period intestinal obstruction is not common in childhood. If there has been no previous abdominal operation, obstruction is usually secondary to a congenital anomaly. The principal causes are inguinal and internal hernias, intussusception, congenital mesenteric defects and congenital bands as from a Meckel diverticulum or with malrotation. The cause is seldom a neoplasm. There is an occasional patient with perforated appendicitis in whom the obstructive symp-



toms are more prominent than those specifically related to the inflammation.

Operative management does not differ appreciably from that in adults. More care is required in preoperative preparation, however, since dehydration and electrolyte imbalance develop more rapidly in a small child.

### Gastrointestinal Bleeding

Children seldom require operation for gastrointestinal bleeding. On the other hand, the indications for *urgent* operation are identical: rapid and continuing blood loss. A small absolute volume of blood may represent a large relative loss in an infant. Most physicians agree that operation is indicated when the twenty-four-hour blood loss in an adult patient is 2.5 liters—or approximately 50 percent of the estimated blood volume. In a 10-kg (22-pound) child, the equivalent amount is only 400 ml.

The major causes of massive gastrointestinal bleeding in childhood are duodenal ulcer, esophageal varices, Meckel's diverticulum and duplications. Unlike its counterpart in adults, duodenal ulcer in a child seldom perforates or produces pyloric obstruction. On the other hand, massive bleeding is not rare, usually being seen in acute duodenal ulcers secondary to steroid therapy (such as that given for the nephrotic syndrome), central-nervous-system disease or burns. In fact, it is so common in patients with head injury and burns that many authorities recommend prophylactic antacid therapy. Ligation of the bleeding vessel with pyloroplasty and vagotomy has largely supplanted gastrectomy, although if the latter is necessary, it is well tolerated and does not inhibit later growth of the child.

Bleeding esophageal varices can usually be controlled by nonoperative means, such as antacids and balloon tamponade. In the very small child a Miller-Abbott tube can be used to tamponade the gastric cardia. In the older child the small Blake-

more-Sengstaken tube is available. As an emergency procedure for uncontrollable, life-threatening bleeding, transthoracic ligation of the varices is the simplest and safest course. It is but a temporizing measure, however, and more definitive therapy will be necessary.

Meckel's diverticulum may cause bleeding from ulceration when gastric mucosa is present. Bleeding may be massive and is usually preceded by vague abdominal discomfort. Dark, bloody stools usually are followed by bright-red blood. Resection is curative.

Duplications of the gastrointestinal tract occur at any level. Tubular duplications may contain gastric mucosa, which causes ulceration within the duplication or in the normal bowel adjacent to the opening. Resection of the duplication is necessary.

### Trauma

Abdominal trauma is not significantly different in the child and the adult. The same spectrum of injury occurs. The indications for operation and the operative procedures do not differ.

One form of abdominal trauma that is more common in children is intramural hematoma of the duodenum. Symptoms of high intestinal obstruction develop a day or two after injury. A characteristic narrowing of the duodenum is present on barium study. Treatment is either evacuation of the hematoma or gastroenterostomy. Awareness of the problem, with early recognition, and prompt therapy are the prime factors in successful care.

### Summary

Various surgical causes of acute abdominal emergencies in children are reviewed. Conditions requiring prompt abdominal exploration are discussed: diseases manifested predominantly by pain; intestinal obstruction; gastrointestinal bleeding; and trauma.

(The references may be seen in the original article.)

## THE PROBLEM OF FEVER OF UNKNOWN ORIGIN\*

Emanuel Appelbaum, Professor of Clinical Medicine New York University School of Medicine, New York, N.Y., Bull NY Acad Med 43(10):889-898, October 1967.

Despite advances in knowledge and the development of many new diagnostic techniques, one still encounters instances of fever that cannot be readily explained. These cases, generally referred to as FUO or fever of unknown origin, constitute a challenging problem to the clinician. It is my purpose to discuss briefly the more important diseases and entities to which the physician must be alerted when faced with a problem of unexplained fever. As suggested by Beeson, the diseases to be considered may best be grouped under four headings: infections, neoplasms, collagen diseases, and miscellaneous.

### Infections

*Tuberculosis.* One of the most important diseases requiring consideration in cases of fever of unknown origin is tuberculosis, particularly the miliary form, which is often difficult to diagnose. It is well known that in miliary tuberculosis a roentgenogram of the lungs is frequently nonrevealing until late in the course of the disease, when tubercles or effusions may appear. In the more chronic forms of miliary tuberculosis, in which the infection is more indolent and lesions are less widely disseminated, the patients may remain asymptomatic for a long time. It is also well to bear in mind that a tuberculous infection may be localized predominantly in an extrapulmonary organ or system, as the liver, the meninges, or the genitourinary tract.

In view of the paucity of clinical findings in many instances of miliary tuberculosis it is frequently necessary to resort to a variety of laboratory studies for the purpose of establishing a diagnosis. These include roentgenograms of the lungs and other organs, careful search for tubercle bacilli in the sputum, in gastric washings, stools, urine, and other secretions, and various biopsy examinations. Of particular importance is the performance of biopsy of the bone marrow and of the liver, with diligent examination for the presence of tubercles. In an excellent study on miliary tuberculosis of the liver, Terry and Gunnar noted

that in miliary infection the tuberculous process within the liver is frequently massive and may produce a variety of tubercles: caseating, noncaseating, and granulomatous forms. At times a pleural or pericardial biopsy may prove helpful. On occasion, the bone marrow culture may be positive for tubercle bacilli. On the other hand, it is very difficult as a rule to demonstrate bacillemia. The tuberculin test is not helpful, since a positive reaction does not prove active infection, and a negative result does not exclude with certainty the diagnosis of tuberculosis. It is of interest that, while the liver function tests not infrequently yield an abnormal result, the level of alkaline phosphatase is rarely elevated.

*Histoplasmosis.* This fungus infection is prevalent in some parts of the eastern and midwestern United States. It may appear in an acute disseminated form, with severe systemic symptoms, including fever, hepatosplenomegaly, and lymphadenopathy, or as a chronic disease, simulating cavitary pulmonary tuberculosis. Diagnosis can be made by isolating the fungus in cultures of the blood, bone marrow, sputum, and urine, or in biopsy material. The organism may also be found microscopically in specially stained tissue sections. Changing complement-fixing antibody titers and a histoplasmin skin test converted from negative to positive may be considered as evidence in support of the diagnosis of histoplasmosis. A single positive skin test, however, indicates only exposure to this infection.

*Coccidioidomycosis.* This fungal infection is prevalent in several areas of the western United States. The disease appears in several forms, which may resemble tuberculosis or histoplasmosis. The diagnosis is made by the isolation of the fungus in culture or by the microscopic demonstration of characteristic spherules in properly stained tissue sections. The coccidioidin skin test and the complement-fixation test may be used only as supportive evidence for a clinical impression. It may be noted that cultural isolation of the organism is regarded as hazardous to laboratory workers.

*Malaria.* Although malaria had almost disap-

\* Presented at a meeting of the American-Hungarian Medical Association, New York, N. Y., held at The New York Academy of Medicine, April 14, 1967.

peared from the continental United States by mid-1940, it has remained a highly prevalent disease in certain areas of the world, particularly in Asia and Africa. The incidence of this disease is relatively high in southeast Asia, where many of our military personnel are stationed. It is therefore necessary to consider malaria in persons who have returned from visits to endemic areas. A diagnosis of malaria depends on recognition of the parasite in a stained blood smear.

*Schistosomiasis.* This disease is prevalent in Asia, Africa, the Philippines, South America, and the Caribbean Islands. Patients from an endemic area who have a history of intestinal disease, hepatic involvement, ascites, splenomegaly, and eosinophilia should be suspected of having schistosomiasis. The specific diagnosis is based upon finding the eggs in feces, urine, or in biopsy material obtained from lesions in the colon, rectal mucosa, or the liver.

*Amebiasis.* Contrary to the general impression, amebiasis is not limited to the tropics and is present throughout the United States. It appears at times in sizable epidemics. The most common serious complication of amebiasis is liver abscess, which is generally accompanied by persistent fever. This complication may occur in patients who have no previous history of intestinal disorder. The diagnosis is established by demonstrating the presence of *Endamoeba histolytica* in the stools. Repeated stool examinations are frequently necessary. In some cases it is not possible to find the parasite, especially if antimicrobials have been used. In these instances a response to specific therapy may be regarded as supportive evidence for the diagnosis of amebic infection. While the complement-fixation test is almost always positive in cases of amebic liver abscess, it is rarely used as a diagnostic procedure, largely because of the frequency of false-positive reactions.

*Brucellosis.* This disease is characterized in the main by fever, sweats, weakness, and various pains, which may continue unabated for weeks or months. Contrary to the general impression, the fever is usually not undulant but rather intermittent. Occasionally, sustained fever may be present. It may be well to remember that brucellosis is primarily an occupational disease and occurs most often in farmers, livestock producers, meat packers, and veterinarians. The diagnosis can be definitely established by cultural isolation of the *Brucella* from the blood or bone marrow. The ag-

glutination test also provides a dependable laboratory method for diagnosis, especially if the titers are high. On the other hand, the *Brucella* skin test merely indicates past invasion of the body by the organisms, but it does not mean that active disease is present. It may be noted that leukocytosis is most unusual in this disease.

*Subacute bacterial endocarditis.* In the majority of instances, subacute bacterial endocarditis is readily diagnosed on the basis of typical symptoms and positive blood cultures. There are, however, cases in which the disease is missed for many weeks and months. It is common knowledge that bacterial endocarditis is frequently overlooked in the elderly, who may present a confusing and atypical picture, suggesting the presence of psychosis, renal insufficiency, or gastrointestinal malignancy. In these patients the presence of a slight heart murmur and low-grade fever are frequently disregarded. It may also be noted that in right-sided endocarditis cardiac murmurs, peripheral embolic phenomena, and splenomegaly are often absent. The possibility of bacterial endocarditis should therefore be considered in every patient who has a prolonged fever and a heart murmur, and a series of several consecutive aerobic and anaerobic blood cultures should be done promptly. It is, of course, recognized that blood cultures are negative in about 15 percent of cases; in some of these a bone marrow culture may yield positive results.

*Salmonellosis.* In recent decades there has been a marked decline in the incidence of large epidemics of typhoid fever. The disease, however, still occurs in sporadic form, with cases appearing singly or in small groups. The incidence of human *Salmonella* infections other than typhoid fever is unknown, but in recent years there have appeared reports of many cases of salmonellosis following ingestion of contaminated food products. Some of these patients presented typhoid-like symptoms, including sustained fever. In a case of obscure fever it is therefore necessary to consider the possibility of *Salmonella* infection and to perform cultures of the blood, stool, and urine, as well as agglutination tests.

*Obscure intra-abdominal infections.* In this category may be included occult biliary tract infection, localized suppurations and fistulae resulting from perforations in the gastrointestinal tract or in other viscera, suppurative pylephlebitis with multiple liver abscesses, and pelvic thrombophlebitis. These



cases may be very puzzling and may frequently require repeated radiologic, bacteriologic, and biochemical studies. A clue to the diagnosis may at times be obtained from one of the tests or from a revealing detail in the history. In some instances a laparotomy is essential for definite diagnosis.

*Viral infections.* A considerable number of the acute febrile diseases fail to reveal any evidence of bacterial, fungal, or parasitic infection. Most of these illnesses are very likely of viral etiology. In this category may also be included cases with a clinical picture of infectious mononucleosis lacking laboratory confirmation. While recent advances in virology have been enormous, it is still difficult to apply the newer knowledge routinely to clinical material. On occasion, however, the patient will reveal symptoms suggestive of a specific virus disease, which will lead to the performance of cultures of pharyngeal and fecal material and to early- and late-phase serologic tests. This may result in a definite diagnosis.

#### Neoplasms and Tumors

*Carcinomas.* It has long been known that neoplastic diseases may be associated with various gradations of fever and, at times, also with chills, mimicking an infectious disease. These symptoms have been observed not infrequently in patients with carcinoma of the lung, stomach, colon, pancreas, liver, or adrenal gland. Israel in 1896 was the first to emphasize the importance of fever in the presence of renal neoplasm. Since then, many authors have directed attention to fever as a predominant symptom of hypernephroma. In any case of unexplained fever it is therefore important to perform appropriate radiologic studies, particularly pyelography and renal arteriography. Other pertinent tests include microscopic examination of exfoliated cells and of biopsy material, and radioisotope scanning.

*Lymphomas.* Fever is one of the predominant symptoms of lymphomas, particularly Hodgkin's disease. Of special interest is the Pel-Ebstein type of fever, noted in some cases of Hodgkin's disease. In these instances, the fever occurs in irregular waves of several days' duration separated by periods of remission. Positive diagnosis of the lymphomas depends upon microscopic examination of tissue, and biopsy of one of the enlarged lymph nodes is extremely important. On occasion a laparotomy appears justified for the purpose of diagnosis.

*Atrial myxomas and ball-valve thrombi.* Benign myxomas and ball-valve thrombi present a similar clinical picture, with symptoms resembling those of mitral stenosis and, at times, with symptoms related to obstruction of cardiac blood flow. In addition, the patients have intermittent fever and also, occasionally, embolic phenomena. As noted by Ross *et al.*, a mistaken diagnosis of bacterial endocarditis is frequently made in these cases. The most important diagnostic clue in intracavitary tumors of the heart is the variation of signs and symptoms with changes in the position of the body. The diagnosis can be established by means of angiocardiology.

#### Collagen Diseases

*Acute rheumatic fever.* This disease often presents great diagnostic difficulties, since no specific test is available for its diagnosis. Articular manifestations, erythema marginatum, subcutaneous nodules, fever, signs of progressive heart failure, and prolongation of the PR interval in the electrocardiogram constitute the leading evidences of rheumatic activity. Except for the fever, these definite signs of rheumatic activity are frequently lacking. In some instances of rheumatic heart disease the fever is due to pulmonary embolization and infarction. These cases often require long periods of study and recourse to therapeutic trials of various drugs, as salicylates, corticosteroids, and anticoagulants, before a diagnosis is made.

*Juvenile rheumatoid arthritis.* It has long been known that in juvenile rheumatoid arthritis, fever alone can precede the rheumatic manifestations by weeks, months, or even years. The febrile patterns are variable and have been the subject of study by several investigators. These cases usually require long periods of observation before the diagnosis of rheumatoid arthritis can be made on the basis of the characteristic clinical picture and the roentgenographic and serologic findings. It is important for clinicians to be alerted to the possibility of rheumatoid disease in children who have prolonged or frequently recurring fever.

*Systemic lupus erythematosus.* Fever is one of the predominant symptoms of disseminated lupus, which progressively involves the musculoskeletal, mucocutaneous, renal, cardiovascular, pleuropulmonary, gastrointestinal, neurologic, and hematologic systems. Of great importance is the presence in the patient's serum of a great variety of autoantibodies, including the antinuclear factors, one of which can induce the formation of the lupus erythematosus

(L.E.) cell. The diagnosis of systemic lupus is suggested if the patient has a false-positive serologic test for syphilis, a positive Coombs test, or any one of the antinuclear factors. The presence of a positive L.E. cell test is generally regarded as confirmatory of the disease. However, failure to find these cells does not rule out the diagnosis of lupus erythematosus.

*Dermatomyositis.* This condition requires consideration in patients, particularly those past middle age, who have fever and pain or weakness in muscles, especially those of the girdle, the neck, and proximal parts of the extremities. There may or may not be involvement of the skin. The diagnosis is made by biopsy of affected areas of skin and muscle. It is of interest that in about 20 percent of the cases there is an associated neoplasm of some type.

*Periarthritis nodosa.* Fever may be a dominant manifestation of periarthritis nodosa, which is a disease of diversified symptomatology. Manifestations that should arouse suspicion of this disease include: (1) cachexia and anemia, (2) polyneuritis and polymyositis, (3) abdominal symptoms, (4) signs of renal involvement, (5) hypertension, (6) signs suggestive of infection, as fever and leukocytosis, (7) eosinophilia, (8) bronchial asthma or focal pulmonary infiltrates, (9) skin lesions, such as nodules, purpura, bullae, or ulcers, and (10) signs of acute vascular involvement of the heart, mesentery, or brain. The diagnosis can be made by biopsy of skin and muscle or of an affected artery.

Cranial arteritis in elderly individuals may be placed in the same category. This condition may cause fever, headache, and leukocytosis. When the temporal artery is involved, the diagnosis can be made readily by biopsy of this vessel.

#### Miscellaneous

*Cirrhosis of the liver.* It is well recognized that cirrhosis of the liver may cause considerable temperature elevations, possibly as a result of tissue destruction. Beeson suggests also that patients with cirrhosis may have episodes of chills and high fever, due to an associated Gram-negative bacillus bacteremia. A diagnosis of hepatic cirrhosis can usually be made on the basis of the clinical picture, the course, and the laboratory findings of hepatocellular dysfunction. Occasionally liver biopsy is essential for diagnosis.

*Regional ileitis and ulcerative colitis.* On occas-

sion fever is the principal symptom in these related diseases. The fever is a manifestation of toxicity. In some cases, a prolonged fever results from complications of perforation, such as localized peritonitis, abscess, or fistula. The diagnosis of the primary disease and the complications is usually made by x-ray examination of the gastrointestinal tract and by endoscopy. Occasionally a laparotomy is essential for diagnosis.

*Recurrent pulmonary embolism.* This condition may cause a prolonged fever due to pulmonary infarction, pleuritis, or bronchopneumonia. The emboli originate in right-sided heart lesions or in thrombi of the peripheral veins of the extremities or pelvis. The source of the thrombi may remain obscure for a long time, leading to diagnostic difficulty. In all cases of unexplained fever it is well to bear this clinical entity in mind and to search repeatedly for evidence of peripheral thrombophlebitis. The newer procedures of pulmonary angiography and photoscanning are valuable diagnostic aids.

*Blood diseases.* In some forms of leukemia, hemolytic anemia, and other blood dyscrasias, fever is a dominant symptom and may greatly confuse the diagnosis. However, careful hematologic and bone marrow studies will generally lead to a solution of the diagnostic problem.

*Drug fever.* Febrile reactions to antibiotics and other chemotherapeutic agents constitute the main source of confusion, particularly hypersensitivity reactions to penicillin. Occasionally a persistent fever is due to the prolonged use of a certain drug. The diagnosis is confirmed by the defervescence that follows discontinuation of the suspected drug.

*Periodic fever.* Reimann has called attention to an unusual group of cases in which there were febrile episodes at intervals of 7 to 10 days, continuing for periods of months and even years. These are sometimes associated with leukopenia or abdominal or thoracic pain. The reason for the periodicity of the fever is unknown. The syndrome comprises several etiologic entities, two of which, etiocholanolone fever and familial Mediterranean fever, appear to be hereditary metabolic disorders. Although these two diseases have common clinical findings, they can be distinguished, largely by certain ethnic and biochemical features shown in the accompanying table.

FEATURES DIFFERENTIATING FAMILIAL MEDITERRANEAN FROM  
ETIOCHOLANOLONE FEVER\*

	<i>Familial mediterranean fever</i>	<i>Etiocholanolone fever</i>
Ethnic background	Mediterranean ancestry	Northern and eastern European ancestry
Periodicity	Attacks at irregular intervals	Regular cyclic episodes
Biochemical findings	Hyperfibrinogenemia Proteinuria	Elevated plasma and urinary etiocholanolone

\* Adapted from a table by Cohn, G. L., in: *Cecil-Loeb Textbook of Medicine*, Beeson, P. B. and McDermott, W., eds., vol. II, Philadelphia, Saunders, 1963, p. 1276.

*Factitious fever.* Occasionally, fever is observed in an individual who shows no other signs of illness. If malingering is suspected, the temperature should be checked in the presence of a physician or nurse.

There is no special formula for the study of problems of fever of unknown origin. The clinical investigation should comprise a careful history, a complete examination of the patient, and a selection of appropriate laboratory tests. In the examination particular attention must be given to the search for tender areas, masses, enlarged lymph nodes, and various cutaneous and mucosal lesions, especially petechiae. A diligent search should be made for heart murmurs, with the patient in different positions. Proper appraisal of the size of the liver and spleen is of paramount importance. The fundi must be checked carefully for the presence of hemorrhages, papilledema, and choroidal tubercles. The physical examination should be thorough, with emphasis on signs frequently present in the more common diseases associated with prolonged fever.

The role of appropriate laboratory studies in making a diagnosis hardly needs comment. The pertinent tests have been mentioned already, but several of the procedures require some amplification and emphasis. Blood cultures should be taken in series of four or five successive tests at intervals of one culture every four to six hours. As previously noted, a culture of the bone marrow may occasionally yield a positive result when cultures of the blood are negative. The blood cultures should be made on aerobic and anaerobic media. The significance of a serologic test depends on the height of the positive titer and on the changing of titers during the different phases of a disease. The value of biopsies of the various tissues in making a diagnosis cannot be overemphasized. At times decisive help is obtained from the application of the technique of exfoliative cytology or of special biochemical or hematologic studies. It is, of course, frequently necessary to do various roentgenographic studies, including the special procedures of

tomography, angiography, lymphangiography, and radioisotope scanning.

As previously mentioned, laparotomy may be indicated for diagnosis. In a recent report by Keller and Williams on laparotomy in 46 cases of pyrexia of unknown origin, the cause of the fever was established by the operation in 38 patients, 35 of whom benefited from the surgical intervention.

It is, of course, realized that in many cases a correct diagnosis cannot be made, even after the most comprehensive study. In some instances fever and other manifestations subside without the benefit of a diagnosis. This probably applies to 50 percent of the patients, in some of whom the febrile course is relatively short. In about 40 percent of the cases a definite or presumptive diagnosis results from the use of laboratory tests, from the gradual evolution of typical symptoms, from laparotomy, or from the patient's response to some therapeutic procedure, such as the administration of certain antibiotics, salicylates, or other drugs. However, a response to a therapeutic trial cannot be regarded as absolute proof of a diagnosis. There remains an undiagnosed group of about 10 percent of the patients in whom the unexplained fever continues.

#### Summary

In this presentation I have discussed briefly the more important clinical entities that require consideration in the differential diagnosis of fever of unknown origin. Attention has been directed to pertinent laboratory tests and other procedures that may be of diagnostic aid. It has been noted that in many instances the fever subsides spontaneously without the benefit of a diagnosis, that following study and the application of certain procedures a diagnosis can be achieved in a fairly high percentage of the cases, and that only in a relatively small number of patients does the problem remain unsolved.

(The references may be seen in the original article.)



## TREATMENT OF SMALLPOX AND COMPLICATIONS OF SMALLPOX VACCINATION

*Paul G. Quie MD and John M. Matsen MD, University of Minnesota Medical School, Minneapolis, Minnesota, GP 36(4):131-136, October 1967.*

In early centuries, the only means of protection against death from smallpox was by inoculation with material from pox lesions (variolation). In the 18th century, Jenner found that smallpox could also be prevented by material from benign cowpox lesions. This method of vaccination was practical, safe and effective.

Vaccination programs have been essential public health measures for decades and, since man is the only host for the virus that causes smallpox, universal vaccination could theoretically eradicate the disease. Smallpox has not been eradicated. In fact, it has not even been adequately controlled in large areas of the world. In the subcontinent of India and Pakistan, in the Far East and in parts of Africa, smallpox is still endemic. Through air travel, the disease can be rapidly transmitted anywhere in the world. In 1963, smallpox was introduced in Europe by travelers from endemic areas; contact with the initial five patients resulted in 140 secondary cases and 11 deaths. Therefore, in spite of highly successful vaccination programs in most countries, the probability of smallpox in nearly any community is greater in this jet age than it was a decade ago.

This article will review the treatment of smallpox and its prevention in persons who have been exposed to the disease. The complications of vaccination with vaccinia virus vaccine will also be discussed.

### Treatment of Patients with Smallpox

There have been recent exciting advances in specific antiviral immune therapy and chemotherapy. The studies of Kempe and his colleagues on the immunologic response to smallpox led to the use of vaccinia hyperimmune globulin for prevention of smallpox in contacts of patients with the disease. The systematic distribution of vaccinia immune globulin is a valuable advance in smallpox therapy and in protection against complications of

smallpox vaccination. Since viremia occurs before pustules develop in the skin, treatment of smallpox with hyperimmune globulin during the pustular stage would not be effective. Even high levels of circulating antivaccinial antibodies would have little effect on the disease at this stage.

Methisazone (N-methylisatin thiosemicarbazone) is one of several chemotherapeutic agents effective against viruses. It has been shown to have antiviral activity against smallpox virus and is relatively nontoxic. It is not viricidal per se but acts by preventing maturation of virus particles intracellularly. The smallpox virus multiplies intracellularly in the skin and throughout the body during the prodromal stage of illness; when diagnostic pustules have formed, there is little further replication of virus. Since methisazone is effective only when there is replicating virus, it can be considered useful therapy only during the prodromal and early stages of smallpox—not after characteristic skin pustules have fully developed.

It is evident, therefore, that the most important aspects of *treatment* of smallpox are still those of supportive therapy. The confluent nature and extensiveness of the skin involvement allows rapid loss of plasma. Electrolyte and colloid balance is as challenging a problem as it is in patients with severe burns. Prompt therapy with blood and oxygen is extremely important when shock is present or impending.

Patients with smallpox are extremely susceptible to secondary bacterial invaders. The use of prophylactic antibiotics has been recommended. This would seem undesirable, however, because of the high resistance of most bacterial opportunists in hospital environments. Therefore, scrupulous attention to isolation procedures, careful repeated evaluation for evidence of bacterial sepsis and prompt therapy with appropriate antibiotics in therapeutic doses are recommended.

Although we have not had experience with silver nitrate treatment in smallpox, its remarkable effectiveness in the therapy of severe burns suggests its use in smallpox for protection of involved skin from bacterial colonization.

Each year members of a different well-known medical faculty prepare articles for this regular GP department. This is the fourth of twelve from the University of Minnesota.

## Treatment and Prevention of Smallpox in Contacts

Vaccination of *nonimmunized* contacts of smallpox patients is of little value since the immune response would be inadequate during the incubation period of smallpox but it should be done so that immunity is gained. Vaccinia immune globulin (VIG) would be of value since the passively transmitted antibodies would diminish secondary viremia. Well-controlled trials with VIG conducted in India during smallpox epidemics in 1953 and 1956 proved its usefulness. The recommended dose of VIG is 0.6 to 1.2 ml. per kg. immediately after contact.

The value of methisazone in preventing smallpox in contacts is also well established. The use of this drug during a smallpox epidemic in Madras, India was reported in 1963. In that study, household contacts of smallpox patients were treated within one or two days after admission of the index smallpox case to the hospital. A total of 1,101 persons were treated with methisazone and 1,126 similar contacts were treated with placebo. A striking difference in incidence of smallpox was found. Among those treated with methisazone, there were three smallpox cases, with no deaths. Among the control group, there were 78 cases and 12 deaths. This was a 96 percent reduction in incidence. Methisazone was as effective in persons who had been previously vaccinated as it was in those who had not been vaccinated.

Methisazone is rapidly absorbed from the gastrointestinal tract and is therefore effective by the oral route. It can be obtained from Burroughs Wellcome & Co. and is distributed as an experimental drug under the trade name Marboran®.

The dosage recommended is an initial loading dose of 200 mg. per kg., followed by eight doses of 50 mg. per kg. given at six-hour intervals. The main side effect of methisazone is vomiting, which is a serious disadvantage since the drug is given orally and an adequate loading dose and maintenance drug level for at least 48 hours are necessary. Antiemetics such as cyclizine or chlorpromazine control this complication.

Vaccination is an effective means of preventing smallpox in contacts who have been previously successfully vaccinated. Methisazone is an *additional* protective measure and will not interfere with immune response if it is administered before or at the same time as vaccination. VIG as well as

methisazone should be used if exposure to smallpox is not ascertained until late in the incubation period.

## Complications of Smallpox Vaccination

In recent years, attention has been drawn to the incidence of complications following smallpox vaccination. Neff and his colleagues calculated that an estimated 6,239,000 primary vaccinations and 7,775,000 revaccinations were performed in the United States in 1963. There were 330 "vaccine-associated illnesses," with seven deaths in patients with primary vaccination. There were 17 patients with complications and two deaths in those who were revaccinated. These investigators also found that the complication rate was considerably higher among children under one year of age.

The frequency of preventable complications (i.e., eczema vaccinatum, vaccinia necrosum, accidental vaccination and vaccinia superinfection of other skin disorders) can be decreased considerably by careful screening of potential vaccinees. In addition, there are several general principles which, if followed, would reduce the incidence of complications. Vaccination should be withheld until the second year of life and should be performed with the following precautions: (1) Vaccinate over the insertion of the deltoid, behind the midline. (2) Avoid vigorous cleansing of the vaccination site to prevent virus inoculation of a large area. (3) Wipe away remaining drops of vaccine. (4) Keep the vaccination site dry. Patients with eczema or siblings of patients with eczema, patients with other skin conditions (furunculosis, contact dermatitis, impetigo, etc.) and patients with lowered immune responses (dysgammaglobulinemia, lymphoma, leukemia, blood dyscrasia, steroid therapy, treatment with antimetabolites or irradiation) should not be vaccinated. Pregnancy is also a contraindication for vaccination.

Kempe has recently reported on the use of an attenuated smallpox vaccine, CVI-78, in 1,009 patients suffering from eczema or other skin disorders. No virus dissemination occurred. There were two cases of mild erythema multiforme. Seroconversion was noted in all patients tested. It would seem that this attenuated vaccine may be effective for primary vaccination in patients with skin problems.

VIG is also of value in preventing complications of smallpox vaccination if it is given within

24 hours of vaccination. This can be efficacious in patients with eczema who plan to travel to endemic smallpox areas. The recommended prophylactic dosage of VIG is 0.3 ml. per kg. In a study of more than 100,000 Dutch recruits, VIG decreased the incidence of postvaccinal encephalitis by 76 percent. Methisazone has also been used to reduce complications of smallpox vaccination.

Since 1960, VIG has been prepared and distributed in this country by the American Red Cross. Blood from military recruits is collected six weeks after vaccination and gamma globulin is prepared from the sera with high titers of antibody against vaccinia. VIG may be obtained by conferring with one of the national consultants designated by the American Red Cross.

### Eczema Vaccinatum

Eczema vaccinatum is the development of vaccinia skin lesions other than at the vaccination site, either on a generalized basis or as individual lesions. This occurs in a person with eczema or with a past history of eczema. Sussman and Grossman reported that two-thirds of the patients in their study who had eczema vaccinatum developed this complication after contact with a recently vaccinated person. Neff and his colleagues, in their two studies, reported that 48.6 percent and 16.2 percent of the eczema vaccinatum cases were in contacts. Mortality from this condition has decreased, apparently because of the increased use of specific therapy in the more severe cases. When widespread lesions occur, treatment is similar to the therapy described for smallpox. Intravenous fluids, electrolyte solutions and blood or plasma transfusions may be necessary in these cases.

The use of VIG (0.6 to 1.0 cc. per kg.) has been found beneficial. Kempe and others report that there is evidence for a primary defect in the production of specific antibodies against the vaccinia virus and, therefore, the immune globulin may arrest the progressive lesions.

Methisazone has also been shown to be effective. Kempe has reported on its use in seven patients with severe eczema vaccinatum who continued to have extension of old lesions and development of new ones after four to six days of VIG therapy. All showed prompt and seemingly specific response when methisazone was given orally (initial dose 200 mg. per kg., followed by 50 mg. per kg. every six hours for three days).

### Generalized Vaccinia

Generalized vaccinia lesions may occur in patients without eczema or other underlying skin conditions. The lesions are vesicular and papular and resemble primary vaccination. They appear in crops, usually for a four- to six-day period, often during the height of the primary vaccination reaction. The use of VIG is generally associated with the total cessation of new lesions. Even without treatment, however, the course of generalized vaccinia is usually benign and the mortality lower than with eczema vaccinatum. Methisazone has been used in this complication and should be considered in the more serious cases.

### Vaccinia Necrosum

Vaccinia necrosum (progressive vaccinia or vaccinia gangrenosa) is a lesion of progressive necrosis extending from the site of vaccination. This complication is fatal if untreated. It occurs in patients with serious underlying disease which severely compromises the immune response. These patients may have hypogammaglobulinemia or an inability to respond with delayed-type hypersensitivity. Patients with cancer and those on immunosuppressive therapy are also highly susceptible. The progressive enlargement of the vaccination site is accompanied by nonhealing necrosis. Viremia, osteomyelitis, pneumonitis and myocarditis may also be present. Treatment with VIG is recommended (0.6 to 1.0 cc. per kg. every six to 10 days until the lesion heals).

Brainerd and his co-workers tried methisazone in one patient with this complication and believed it to be of value. Kempe reported on the use of methisazone in nine patients with prolonged, progressive vaccinia necrosum who were unresponsive to antibody therapy (VIG). Five of the nine showed prompt clinical response and virologic cure. The others showed no clinical or virologic response. It has been suggested that multiple exchange transfusions with high-titer blood may be therapeutically useful if VIG and methisazone fail to produce a response. However, this form of therapy may be dangerous in patients with profound loss of immune responsiveness. A "graft versus host" response has been reported in this situation.

### Erythema Multiforme

Erythema multiforme is an allergic reaction to vaccination material. It may occur in the form of



a generalized maculopapular rash within eight days after vaccination. Treatment of erythema multiforme secondary to vaccination is similar to that of any hypersensitivity reaction, i.e., antihistaminics and antipruritics. Patients may develop bullous lesions and require hospitalization and supportive care. Corticosteroids should not be used because of their possible effect on immune response.

### Encephalitis

Encephalitis is a complication occurring in from one in 1,500 to one in 500,000 vaccinations. It occurs most often after primary vaccination in infants less than 1 year of age or in persons more than 3 years of age. Recruits in Holland, where vaccination in childhood is not general, were found to have 15 to 20 times the incidence of encephalitis as that reported for recruits in the U. S. Army. A mortality rate of 25 to 40 percent is found with this complication and there is no evidence that specific antivaccinia therapy is of any value after the symptoms of encephalitis have appeared. A reduction in the incidence of this complication has been reported with the use of prophylactic VIG at the time of vaccination.

### Accidental Autoinoculation

Accidental autoinoculation occurs most commonly on the eyelids, conjunctiva and/or cornea. Other, less common sites are the face, arms and

genitalia. The lesions may result from accidental inoculation at the time of primary vaccination, with secondary lesions from active virus of the vaccinia "take," or they may occur after contact with vaccinated individuals. VIG may be useful in preventing full development of secondary lesions. In the rare vaccinia keratitis, however, there is evidence that VIG may be contraindicated. Methisazone is also effective in secondary lesions. If the autoinoculation lesion is small and uncomplicated and does not involve the eyes, the usual care given a primary vaccination may be all that is indicated.

### Satellite Lesions

Lesions around primary vaccination sites usually require no specific therapy. Very rare complications, such as myocarditis, osteitis, osteomyelitis, pneumonia and neuritis, may occur. Treatment consists of VIG and methisazone and organ-directed therapy as indicated.

### Secondary Bacterial Infection

The development of secondary bacterial infection calls for ordinary principles of infection management, with antibiotics prescribed according to studies of colonizing bacteria. It is an uncommon complication and prophylactic antibiotics are not indicated.

(The omitted table and references may be seen in the original article.)

## THE CONTROL OF INFECTION IN SEVERELY BURNED PATIENTS

*J. Wesley Alexander MD ScD,\* John A. Moncrief COL MC USA,\*\* Surg Clin  
N Amer 47(5):1039-1048, October 1967.*

Severe thermal injuries present some of the most complex and taxing problems encountered in surgical practice. Infection is invariably present in large burns, and septic complications continue to be the most frequent single cause of death in burned patients. The need for more effective means of controlling infection in these patients is urgent and de-

serves the attention of all who treat thermal injuries. The purpose of this manuscript is to review the problem of infection in burned patients and to outline the important principles of management, both preventive and therapeutic.

### Pathogenesis

Normal skin affords an effective barrier to the penetration and multiplication of bacteria. No portion of the skin is sterile, and careful cultures invariably show a multitude of bacteria in surprisingly large numbers. They fail to invade the body, however, pri-

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marily because of desiccation and the antibacterial activity of skin secretions. Burn injury destroys these barriers and infection readily occurs.

Bacteria become colonized on the burn wound through a variety of sources with many opportunities for contamination both at the time of injury and during transportation. Hospitals themselves cannot maintain a sterile environment, and nosocomial contamination is a frequent occurrence. Probably of equal importance is contamination by the patient's own organisms, whether they be from the enteric tract, the respiratory tract, the adjacent skin, or deep-seated sweat glands and hair follicles. Studies by Altemeier and MacMillan have emphasized the fact that all burn wounds are contaminated with bacteria immediately or shortly after the injury. They also demonstrated qualitative changes in the flora of burn wounds. Initially, staphylococci, streptococci, and clostridial organisms could be obtained by culture, but later these became replaced with enteric pathogens such as *Proteus*, *Pseudomonas*, and *Aerobacter*. Their findings, and those of others, emphasize that both the patient himself and the hospital are important sources of contamination.

The burn eschar is a nonviable, devascularized structure which is a favorable milieu for bacterial growth. It may harbor phenomenal numbers of bacteria—over one billion per gram of tissue—and serve as a potent focus for systemic bacterial invasion. Such a large number of bacteria in the burn eschar itself may be a major factor in causing septic death even when there is no systemic bacterial invasion. Diffusible bacterial toxins from the eschar may enter the systemic circulation in lethal amounts, while leukocytes are unable to penetrate the necrotic tissue to serve as a defense against bacterial proliferation. The burn wound thus may be considered to be analogous to a large undrained abscess. Order et al. have shown that second-degree thermal injuries may be converted to full-thickness injuries as a result of infection, which thus contributes to both morbidity and mortality merely by producing a more serious injury.

In addition to the presence of a nonviable eschar which invariably becomes contaminated, there also occurs in a burned person a suppression of the ability to cope with infection, which is related both to the size of the burn and to the time at which a challenge is made. Immediately following large burns, experimental animals become acutely and severely susceptible to bacterial infection, although this susceptibility is lost after 24 to 48 hours. This immediate susceptibility to infection has not been entirely explained, but

it is probably not mediated by serum factors since the bactericidal effect of the plasma did not seem to be significantly altered following thermal injury in the studies of Liedberg, Balch, and McRipley and Garrison. Phagocytosis has been shown to be slightly depressed, but probably of more importance would be an inability of phagocytes to kill ingested bacteria. Balch has demonstrated a rather striking change in the cellular response to cutaneous injury (Rebuck test), but he indicated that the cells showed little or no change in ability to phagocytize killed bacteria placed upon the wound. McRipley and Garrison and Liedberg, on the other hand, have demonstrated a decrease in phagocytosis both by reticuloendothelial cells and neutrophils in experimental animals immediately following burn injury. The ability of phagocytes from a burned individual to kill ingested microbes has not been adequately studied.

Alexander and Moncrief have shown in burn patients and in experimental animals that there is an impairment of the ability to produce specific antibodies to some antigenic substances but not to others. Their findings may partially explain why some burned individuals fail to recover from repeated or continuing bacterial insults.

It can be said that infection following burn injury results from a combination of several factors including loss of a protective covering, the presence of avascular tissue in which bacterial proliferation may readily occur, an alteration of the normal inflammatory response, and an early diminished host response to a bacterial challenge.

### Specific Measures for Control

#### Prevention of Contamination of the Burn Wound

If colonization of the burn wound by bacteria could be prevented, infection would not be possible. Landy and Haynes and Hench have presented the theoretical considerations of germ-free isolators as a barrier against nosocomial pathogens in the burned patient, but the use of such measures seems to us expensive, ineffective, and impractical.

While bacterial contamination of the burn wound invariably occurs, it is important to stress the necessity for avoiding *undue* contamination, since the number of bacteria in an inoculum contributes directly to the subsequent development of infection. It has been the practice at the Surgical Research Unit

to use clean but not sterile techniques in handling burned patients. This technique includes the use of sterile instruments during any debridement procedure or surgical manipulation, the use of sterile gloves whenever coming into contact with the burn wound, washing the hands after caring for a patient, and strict observance of techniques for decreasing contamination from formites and other objects in the patient's surroundings. Hubbard tanks are vigorously cleaned after use. Such a program holds bacterial colonization of the burn wound to a minimum without compromising patient care.

It appears that the choice between open and closed methods of treatment is not a significant factor in the prevention of ultimate bacterial proliferation in the burn wound. While the closed method decreases the number of bacteria gaining entrance to the wound, the moist, warm environment that it produces promotes proliferation of bacteria already present. Conversely, exposure of the burn wound makes it more vulnerable to contamination from a variety of sources, but the wound itself less favorably supports bacterial growth because desiccation inhibits bacterial proliferation on the surface.

#### Gamma Globulin and Convalescent Serum

A number of investigators have attempted to evaluate the beneficial effects of pooled gamma globulin because of the theoretical considerations and because experimental evidence in animals has indicated limited effectiveness. In 1963, Liljedahl and co-workers reported their experience with the use of gamma globulin at the Burns Institute at the Karolinska Sjukhuset and concluded that the administration of human gamma globulin and plasma in the first week to patients with extensive burns reduced the incidence of infection and of mortality from sepsis. They emphasized, however, that the gamma globulin was usually given in the form of blood and plasma, and also indicated that the general care of the patients was improved during the period. In their studies, patients with 60 percent burn injuries eliminated more than 95 percent of a dose of  $^{131}\text{I}$ -labeled gamma globulin during the first 48 hours after its administration. Over 10 grams of gamma globulin were catabolized daily in some of their patients. Kefalides et al., in reviewing their experience at the Peruvian Burn Institute for Children, likewise concluded that the administration of gamma globulin helped to prevent sepsis. Many of the patients received prophylactic antibiotics, however, and the number of vari-

ables in their report was so large it is difficult to draw firm conclusions from their experience. More recently, Stone et al. have performed a prospective study for the evaluation of gamma globulin for prophylaxis against burn sepsis in 100 selected patients, 40 of whom served as controls. Control and experimental patients were cared for during the same period, and treatment was otherwise similar in all. They concluded there was no significant difference between the groups and that the passive administration of pooled gamma globulin had little to offer. It is not surprising that pooled homologous human gamma globulin has little or no beneficial effect in the prevention of infection following thermal injury since specific gamma globulin is needed, and specific gamma globulin for any one organism in pooled gamma globulin preparations is of low titer. Also, homologous gamma globulin has a rate of catabolism in burned individuals several times that of normal values, with a half-life of only two to four days compared to 25 days in normal individuals.

The use of convalescent burn serum or plasma has been advocated by several investigators over the past few years. A recent well-controlled study by Boco-negra et al. effectively summarizes their experience and the point of view taken by others as well as ourselves. When plasma from convalescent burned patients was compared to normal plasma, it was found that there was "no evidence that plasma from convalescent burned individuals is superior to normal plasma in the treatment of severely burned infants."

In summary, it would appear that homologous pooled gamma globulin and convalescent serum or plasma are not beneficial in preventing septic complications in severely burned patients.

#### Specific Immunization

Specific antisera may have as much as 500 to 1,000 times as much activity against gram-negative bacteria as pooled gamma globulin. Furthermore, both active and passive immunization in burned animals has been highly effective in preventing invasive infection by *Pseudomonas* organisms. Clinical trials are currently in progress to evaluate the effectiveness of immunization for *Pseudomonas* in human patients, but the antigen is not yet available for widespread utilization.

#### Prophylactic Systemic Antibiotics

A review of the experience from various burn centers indicates that systemic antibiotics administered



prophylactically, with the possible exception of penicillin for the prevention of infection with beta hemolytic streptococci, are ineffective in preventing infection in severely burned patients. The ineffectiveness is a result of the relatively poor penetration of systemically administered antibiotics into the avascular and necrotic burn wound eschar, and also from the presence of numerous varieties of bacterial organisms in the burn wound. Suppression of an antibiotic-sensitive organism all too frequently leads to the emergence of another which is resistant to that antibiotic. Thus, not only are systemically administered antibiotics ineffective, but they may be harmful in that they promote superinfections which are quite difficult to treat.

#### Systemic Antibiotics for Established Infections

While systemic antibiotics are ineffective in preventing infection, their beneficial effect in established invasive infections cannot be questioned. Local but invasive infection of the vascularized tissues subjacent to the burn wound eschar or graft should be treated promptly, not only to prevent conversion of a second-degree burn to a full-thickness injury and loss of grafts, but also to prevent systemic invasion. When this type of infection occurs, it is usually due to streptococcal or staphylococcal organisms, and the selection of antibiotic therapy should be based upon this probability. Septicemic conditions require immediate attention.

The selection of the appropriate antibiotic for treatment of both systemic and local infections should be based upon sensitivity tests whenever possible. However, it is both impractical and harmful to withhold antibiotic therapy until such tests can be obtained. A guide for the administration of antibiotics is helpful in the treatment of established infections when the identity of the offending organism has not been established. A Gram stain of the exudate from burn wounds can be utilized effectively to aid in this selection. The following schema is based upon our experience at the Surgical Research Unit, but is not necessarily representative of the preferred selection of antibiotics for specific organisms at other institutions because of varying sensitivity patterns seen from one area to another. Penicillin is universally the therapeutic agent of choice for beta hemolytic streptococcal infections. It must be noted that methicillin is often ineffective against beta hemolytic streptococci, while other synthetic penicillins apparently are effective. Infections from staphylococci respond to

the administration of either methicillin or oxacillin, although other antibacterial agents may be useful. Methicillin remains our choice as a primary therapeutic agent in life-threatening staphylococcal infections when sensitivity tests are not yet available. Gram-negative infections can be particularly problematic. Infections with *Proteus* usually respond to chloramphenicol, infections with *Aerobacter* to either chloramphenicol or oxytetracycline, infections with *E. coli* to chloramphenicol or colistin, and infections with *Pseudomonas* to colistin, bacitracin, or gentamycin. Combined therapy with chloramphenicol and colistin is often effective in life-threatening gram-negative infections where the species of bacterium has not been established.

#### Local Care of the Burn Wound

The care of the burn wound deserves the utmost attention because good care contributes more to the control of infection in the severely burned patient than any other single factor. Consistent with overall therapy, devitalized tissue should be removed as soon as possible because infecting organisms are removed with the dead tissue, and the total bacterial load in the burn wound is effectively decreased.

Upon the patient's admission to the hospital, the burn wound should be scrubbed with soap and water to remove any contaminating dirt and debris. Blisters should be opened, and all devitalized tissue at the site of blister formation should be removed. Hair-bearing areas which have been burned should be shaved. As soon as the patient's condition permits, he should be transported daily to the Hubbard tank or whirlpool bath for cleansing and debridement. Convenient accessibility of the wound with the open method of treatment promotes more frequent care.

Massive excision has been utilized for the removal of devitalized eschar, but this has not significantly decreased the mortality in severely burned persons. We do not recommend its use at the present time.

#### Early Grafting of the Burn Wound

It must be emphasized that the early removal of eschar with grafting is advantageous in the prevention of late infectious complications and should be expedited. In patients with large burns, when topical chemotherapy is being administered, it is sometimes helpful to use closed dressings on one portion of the burn wound to speed up separation of the eschar

while another area is continued with topical therapy, since the latter has been found to delay separation of the eschar by inhibiting bacterial autolysis. As soon as the wound is satisfactory, homograft or heterograft may be applied with changes of the graft every one to four days until the graft bed is suitable for an autografting procedure. Once autografting has been accomplished and the grafts are well taken with complete coverage, infection will not occur.

### Topical Chemotherapy

Since bacterial colonization of the burn wound with subsequent multiplication in the eschar has been recognized as a logical occurrence for many years, topical chemotherapy has been tried with almost every antibacterial agent imaginable. The majority

of these medicaments were placed in oil-based ointments, which not only prevented the release of antimicrobial agents from the carrier, but also produced a greasy covering of the burn wound, beneath which bacteria often flourished. The introduction of a water-soluble carrier has probably been one of the most significant contributions to the concept of topical chemotherapy. Concurrent with the use of a water-soluble carrier was the utilization of an agent which has a wide bacteriostatic spectrum, mafenide (Sulfamylon). Topical Sulfamylon therapy has been used in the treatment of burns at the Surgical Research Unit since January, 1964, with a striking reduction in the mortality from infection and, more specifically, from burn wound sepsis (Table 1).

TABLE 1.—Burn Mortality at Surgical Research Unit

	PERCENT BURN									
	0-30		30-40		40-50		50-60		60-100	
	Number Patients	Percent Mortality	Number Patients	Percent Mortality	Number Patients	Percent Mortality	Number Patients	Percent Mortality	Number Patients	Percent Mortality
1962-1963 (No Sulfamylon)	140	4.3	36	44.4	36	61.1	23	78.3	27	88.8
1964-1965 (Sulfamylon Treated)	188	1.1	46	4.3	26	23.1	28	42.9	28	85.7

Sulfamylon is a sulfa drug (para-aminomethylbenzene sulfonamide hydrochloride) which is non-toxic, highly diffusible, and readily eliminated from the body. It is able to diffuse readily into the devitalized burn wound eschar and exerts an antibacterial activity against a wide spectrum of organisms, although a high concentration is necessary for the suppression of most. Quantitative cultures of burn wounds treated with the Sulfamylon cream have shown the presence of bacteria in these wounds, but in greatly reduced numbers (Table 2). The benefits and side effects of Sulfamylon

therapy have been discussed adequately by Moncrief et al.

Other methods of topical antibacterial therapy have been successful. Among these, the use of silver nitrate compresses, introduced by Moyer et al., is particularly noteworthy. This, likewise, is an effective method for controlling burn wound sepsis when properly applied, but has the disadvantage that care of the patient is more demanding than with Sulfamylon. The use of silver nitrate is discussed in detail elsewhere in this volume. Gentamycin has also been used recently with success.

TABLE 2.—Quantitative Bacteriology of Burn Wounds

	NO. CASES	NO. SAMPLES	BACTERIA PER GRAM OF TISSUE	
			Average	Range
1963 (No Sulfamylon)	12	43	$6 \times 10^7$	$10^5-10^9$
1964 (Sulfamylon Treated)	9	38	$8.4 \times 10^4$	$10^2-10^5$

### Principles of Management

From the foregoing discussion, several basic principles of management are to be emphasized:

1. Avoid undue contamination of the burn wound.
2. Administer systemic antibiotics only when indicated for specific invasive infection. The choice of drugs should be based upon sensitivity tests as soon as they are available.
3. Prophylactic systemic antibiotics should not be given because they are ineffective and promote the emergence of antibiotic-resistant organisms.
4. Coverage of the burn wound with autografts should be accomplished as soon as possible. This can be facilitated by the judicious use of homografts and heterografts.

5. The administration of homologous pooled gamma globulin or convalescent burn plasma is ineffective in preventing sepsis in burn patients.

6. Specific immunization against problem pathogens shows promise experimentally and deserves clinical trial.

7. Daily local cleansing and debridement reduce the number of bacteria in the burn wound and are vitally important in overall care.

8. The application of topical chemotherapeutic agents can aid greatly in preventing burn wound sepsis. Sulfamylon applied in a water-soluble carrier appears to be the most suitable agent in use at the present time. Silver nitrate compresses and topical gentamycin also can be effective when properly used.

(The references may be seen in the original article.)

## MEDICAL ABSTRACTS

### PATHOPHYSIOLOGY OF ACUTE FALCIPARUM MALARIA II. FLUID COMPARTMENTALIZATION

*MAJ John P. Malloy, MC USA, CAPT  
Marion H. Brooks, MC USN, et al.,  
Amer J Med 43(5):745-750, Nov 1967.*

Studies of body fluid compartmentalization in patients with naturally acquired falciparum malaria demonstrated an increased plasma volume during the acute phase of the illness with a return toward normal during convalescence. There was no significant abnormality of total body water or extracellular fluid volume. It is suggested that generalized vasodilatation during the acute illness decreases effective circulating blood volume and that the increase in plasma volume represents a compensatory attempt to correct this homeostatic defect.

### LIPOID PNEUMONIA

*Walter D. Schwindt, MD, Robert A. Barbee,  
MD and Richard J. Jones, MD, Arch Surg  
95(4):652-657, Oct 1967.*

The abnormal pulmonary shadow in an adult immediately arouses one to think of tumor. Often the physician becomes so focused on this possibility that after a few screening procedures to exclude the possibility of tuberculosis or even an involved

investigation to determine a primary source of the tumor, the patient is then subjected to a major surgical procedure. Lipoid pneumonia should be kept in mind for patients who have an atypical pattern for tumor on chest x-ray films or in patients with a known exposure or ingestion of fatty compounds. What has been assumed to be typical for lipoid pneumonia is a widespread bilateral pneumonic process which slowly resolves. This picture appears to be the exception rather than the rule.

### THE USE OF RADIOISOTOPE SCANNING IN MEDICAL DIAGNOSIS

*Milo M. Webber, MD, et al., Ann Intern Med  
67(5):1059-1083, Nov 1967.*

The field of radioisotope scanning in medical diagnosis is one of the fastest growing fields in medicine today. A good share of the credit for this growth goes to technological advances in instrumentation and availability of new and more desirable radioisotopes. Usefulness of brain scanning, lung scanning, liver scanning, and cardiac blood pool scanning has been discussed in this conference. The methods, the applications, and the clinical usefulness of the procedures have been reviewed.

Brain scanning has become a proved useful procedure to demonstrate intracranial pathology. Its lack of mortality and morbidity permits the use of



brain scanning as a screening test. Accuracy is entirely comparable with other procedures.

Lung scan procedures are much younger in their development; there is no question, however, that perfusion lung scanning demonstrates in a unique visual manner the distribution of blood flow to the lung. The technique has been shown to be able to demonstrate emboli too small to be shown in the angiographic procedure. The interpretation of information gained from lung scans in other diseases is currently evolving.

Liver scan procedures can provide information as to the presence and location of abscesses, tumors, and cysts of the liver if they are over approximately 2 cm in diameter. The scan is useful in showing the effects of cirrhosis.

Cardiac blood pool scanning has been improved recently by the addition of newer isotopes. It is now possible to easily demonstrate pericardial effusion, cardiac dilation, and aneurysms of the ventricles or the great vessels. This technique will also demonstrate placental localization as well as aneurysms of the aorta outside the cardiovascular silhouette.

#### MALARIA—RECENT PROGRESS AND PROBLEMS

*Franklin A. Neva, MD, New Eng J Med*  
277(23):1241-1252, Dec 7, 1967.

Various circumstances dictate the need for current review and reassessment of malaria. Until recently, the disease occupied the back shelf of domestic medical interests although remaining an important problem internationally. Whereas malaria is most dramatic currently in the context of military operations in Southeast Asia, it is the emergence of drug-resistant strains of malaria parasites that highlights the subject today. This resistance of certain plasmodia to modern drugs was noted before the expansion of hostilities in Vietnam, but the

malaria problem has become magnified and more complicated as a result of the war. Quite apart from the military implications, however, is the increased importation of malaria into the United States resulting from expanded international travel by American citizens and by nationals of other lands.

This paper reviews recent advances and the current status of knowledge of malaria, with emphasis on the aspects of the disease that are important to the physician. It is remarkable that an entity as old and as well known as malaria continues to exhibit new aspects and to provide new information. During the last decade, for example, it has come to be realized that the consequences of malaria can affect the genetic make-up of human populations through selective mortality; there are new insights into the immunology, there is evidence that man may be naturally subject to simian malaria, and now problems associated with drug-resistant organisms have appeared.

#### PERINEPHRIC ABSCESS: A REPORT OF 71 CASES

*Oscar Salvatierra, Jr., W. Bruce Bucklew and*  
*James W. Morrow, J Urol 98(3):296-302,*  
Sept 1967.

Seventy-one cases of perinephric abscess are presented and analyzed. Whereas blood-borne staphylococci were previously reported as the principal etiological mechanism, the current series reveals the majority of cases to be secondary to direct extension of a primary infectious renal process. *Proteus* and *E. coli* were the most frequently cultured organisms.

The treatment of perinephric abscess should include incision and drainage together with preoperative preparation of the patient with appropriate antibiotic coverage. It is imperative that a progressively septic and potentially fatal course be prevented by early diagnosis.

## DENTAL SECTION

### AGE CHANGES IN THE BLOOD SUPPLY TO HUMAN TEETH

*S. Bernick, J Den Res 46(3):544-550,  
May-June 1967.*

Noncarious teeth from 150 nonhypertensive persons aged 40-70 years were compared to those of 30 persons under 20 years of age, to investigate the effects of aging on the blood vessels of dental pulp.

In young teeth, the pulp consisted of a modified connective tissue resembling mesenchymal tissue. It contained fibroblasts and macrophages but no mast cells. The fibers were both precollagenous and collagenous. Elastic fibers were absent. The pulp was highly vascular, with main blood vessels entering and leaving through the apical forearm. Scattered throughout the pulp, typical arterioles consisted of endothelial layers abutting directly on a thin internal elastic membrane. The media consisted of one or two layers of muscle cells, and the adventitia contained both collagenous and elastic fibers.

Arteriosclerotic changes were seen as early as 40 years of age. In the aging process, the blood vessels and nerves appeared to become more prominent in the core of the pulp. One of the earliest

changes in the arterioles was deposition of a PAS-positive material directly subendothelial, obliterating the internal elastic membrane. Other arterioles in the older pulps showed intimal hyperplasia and a greatly narrowed lumen, and this hyperplasia consisted of both cellular and fibrous proliferation. Another typical vascular change in old pulp was an elastic fiber proliferation in both intima and media.

Diffuse fibrillar calcification of the pulp seen in over 90 percent of the old teeth involved the root portion more frequently than the coronal portion. As this diffuse calcification advanced, calcification of the arteries also occurred. This began in the adventitia and progressed into the media and intima, and eventually eroded into the blood vessels. As a result of these changes in the apical area, there was a relative decrease in number of arteries and terminal branches supplying the coronal portion of the pulp.

Whereas in young teeth, terminal capillary networks were seen passing through the odontoblastic layer to direct relation with the predentin, the older teeth showed a diminution in coronal blood vessels and few arterioles and capillaries in the odontoblastic layer. These aging changes were usual, regardless of presence or absence of pulpal calcification.

## PERSONNEL AND PROFESSIONAL NOTES

### CIVIC ACTION PROGRAM

Personnel of the Naval Dental Corps have participated in the Civic Action Program in Vietnam by providing humanitarian treatment to Vietnamese civilians in areas adjacent to those where Marine units were operating. During the period June 1965-September 1967, a total of 238,288 dental procedures were reported on 122,927 Vietnamese civilians. Of the above total, 122,474 were extractions.

During World War II, officers of the Dental Corps provided treatment to the civilian population of the islands of the Pacific as the occupation proceeded with the westward advance of the Allied Forces. Figures are not available to indicate the extent of this participation.

### MACHINE ACCOUNTING ERRORS

It has been brought to the attention of the Dental Division that instances of undue delay in the requisitioning of equipment have occurred. Information received indicates that incorrect data, i.e., wrong stock numbers, etc., submitted on the requisitions have resulted in rejections of the requisition cards by the accounting machines. Standard procedure at this point would dictate return of the requisition to its originator. Unfortunately, this does not always occur. Therefore, it is strongly urged that individuals requiring items of equipment for ship alterations, new buildings, etc., at specific dates, and for urgent needs, be advised of this possibility. Positive follow-up action should be taken if it appears

that the lead time for receipt of equipment is in jeopardy.

#### SCHOLARSHIP FUND ESTABLISHED FOR LT MILLS

A scholarship fund in memory of LT Robert Perry Mills, DC USN, killed November 2, 1967, by mortar fire while serving with the 3rd Marine Division in Vietnam, has been established at the University of Texas at Arlington, Texas.

The fund will be known as the "Dr. Robert Perry Mills, Jr., Memorial Pre-Dental Scholarship Fund." Contributions may be sent to the University of Texas Arlington Foundation.

#### DENTAL CARE PROGRAM FOR RESERVISTS

Approximately eighteen months ago it was determined that the hundreds of reserve appropriate duty dental officers attached to Naval and Marine Corps Reserve Training Centers and facilities throughout CONUS, if supplied with proper equipment, could better fulfill their mission. As our five-year dental equipment modernization plan at ship and shore activities progresses, a great deal of usable excess equipment may be transferred to these centers. This will accomplish two extremely important purposes; first, it will improve the dental environment for examinations; and second, it will greatly increase the potential of establishing preventive dentistry programs for the reservists.

Through the use of questionnaires mailed directly from the various commandants to their reserve training centers, it was determined which ones had the proper space and could best utilize this equipment. It is extremely gratifying to know that the program has met with remarkable acceptance.

To better prepare the reservists for the preventive dentistry program, it is suggested that the appropriate duty dental officer initiate a short series of oral hygiene lectures. Included would be the showing of the Bureau of Medicine and Surgery produced motion picture films, "Preventive Dentistry, Prevention of Oral Disease," (MN-9863), "Oral Hygiene," (MN-8952), and "Preventive Dentistry II, Professional Responsibility," (MN-9860B).

This procedure would serve to emphasize the importance of good dental health.

A Preventive Dentistry Kit, Patient, (6520-890-2080), is now available in the Federal Stock Catalog for use in teaching self-care measures. The special SnF<sub>2</sub> compatible pumice, and topical SnF<sub>2</sub> (6505-065-7442) may also be purchased by funds held in the operating budget of reserve centers and facilities for medical and dental needs.

It is important to completely familiarize the commanding officer and his staff of the achievements and the end results of this program, which could reduce the dental caries rate of his reservists.

#### ACADEMY OF GENERAL DENTISTRY

The Academy of General Dentistry had its inception following a meeting in Chicago in 1952 by a group of individuals dedicated to follow through on an idea conceived by Doctor T. V. Weclaw, of that city, that would require participation in a program of continuing education as a prerequisite for membership.

The purpose of the Academy is to inspire the general practitioner to improve his knowledge, skill and ability, through a continuous educational program, above that attained upon his graduation from dental school.

Currently it is estimated that within seven years after graduation one half of what was learned will be either wrong or obsolete. This serves as the underlying requirement that the practicing dentist continue his education to keep abreast of the rapid advancement of knowledge in the scientific world.

The Academy provides two classifications of membership. Associate Membership requires active practice, membership in the American Dental Association, and the completion of 17 hours of continuing education courses at university level during the first year. If the member has been in practice for three years, upon completion of the above requirement, he becomes an Active Member and agrees to complete the balance of fifty (50) hours of continuing education within the next two years. To retain active membership upon fulfillment of the above requirements, he must complete fifty (50) hours of study every three years.—Bull Phila Cty Den Soc 32(7): 19-20, Apr 1967.



# NURSE CORPS SECTION

## OBSERVERSHIP TRAINING PROGRAM FOR MILITARY NURSES OF FRIENDLY-ALLIED NATIONS

A foreign observership program in Nursing Service Administration has been in existence at Oak Knoll Naval Hospital since 1954. Navy nurses from friendly allied nations are invited to come to Oak Knoll to observe the techniques of administration, supervision, and leadership as demonstrated in the United States Naval Hospitals.

In addition to its technical aspects the twenty-six week program is designed to promote among foreign trainees an active appreciation of American values and ideals, strong confidence in American power and purpose and an understanding of the role of the armed forces in a democratic society.

Because of the two-fold nature of the program, it has been divided into two sections; the social and community oriented section under the control of the administrative department of the hospital, and the technical nursing administration section which is under the control of Nursing Service.

The community relations portion of the traineeship consists of language classes given by a volunteer Red Cross worker, invitations to private homes and to affairs set up to introduce foreign students to each other, tours of the community, a meeting with the mayor and governor if possible, and a tour which includes a visit to the United Nations in New York City and the government buildings in Washington, D.C. These community tours are directed toward demonstrations of the democratic processes as they function in this country.

The nursing service administration section is tailored to the individual trainee's needs and desires although it includes at least a week of observation in each clinical area and each special department where nurses are assigned.

The trainee spends a week in orientation with the nursing education coordinator. She familiarizes herself with the manuals and the philosophies and functions of this particular nursing service department. During this time the educational coordinator is able to discover special interests and needs and can adjust the schedule accordingly. The present observer feels that she will probably return to the Philippine Islands to teach Operating Room

Technique to corpsmen, and is therefore spending as much time as possible with the instructor of the Operating Room Technician's School.

The trainee spends a week with each area supervisor and with the heads of special departments. She makes observations, keeps a diary, reproduces unclassified material for her personal use, and is given much literature by the various department heads.

In addition to observing the administration of various departments, the trainee does bedside care in the special care unit. In this way she gains a working knowledge of the specialized equipment and our nursing techniques. The trainees consider this portion of the program extremely valuable and have enthusiastically welcomed these learning opportunities.

According to the enthusiastic reports received from former observers, this program has fulfilled its professional commitment and has certainly strengthened our bonds with the parent country.

The greatest problem is that of loneliness since, during the past few years, each foreign visiting nurse has been alone. In spite of social invitations, it is difficult for a foreign national to be alone in a strange country for six months.

## HOSPITAL HEROINES

On July 4th LTJG Kenlyn Walling, ENS Dorothy Finan, ENS Alexandra Garrison and ENS Carol Moore were enjoying themselves while on leave at Short Beach, Long Island, New York when suddenly there was a serious boating accident involving two young boys. Disregarding any inconvenience to themselves and acting in the best tradition of their profession and training, these nurses instinctively and immediately offered their assistance.

Their rapid action and excellent administrations of treatment were credited by the parents of one of the victims for saving their son's life.

In a letter from his Washington office, Congressman Herbert Tenzer commended these young ladies for their skill.

CAPT Arje, the Commanding Officer, delivered individual letters of appreciation from the Commander, Third Coast Guard District, to the heroines with his personal congratulations.—Naval Hospital, St. Albans, N.Y.

## RESERVE SECTION

### ACDUTRA—PART II

The previous article discussed who must take ACDUTRA and cogent reasons why. It is now proper to continue with a few more points to keep in mind. Referring again to and quoting the Bureau of Naval Personnel Manual Article H-4202 (2) (3):

"(2) Commandants and other authorized commanders are authorized to prescribe the type of active duty for training for reservists under their jurisdiction. The type of duty assigned should be that most appropriate to the reservist's grade and designator or rating and classification, his Naval Reserve status, and his prospective mobilization billet.

"(3) The Chief of Naval Personnel will issue schedules and quotas for active duty for training for reservists."

The funds for ACDUTRA are controlled by and the orders cut by the District Headquarters of the district in which the Reserve Officer resides. The orders and funds for Reserve Flag Officers are under the aegis of the Bureau of Naval Personnel. A Reserve Officer desiring ACDUTRA must apply to District Headquarters via the proper chain of command. The application forms are available from the District Medical Programs Officer, the Naval Reserve Training Center and the Administrative Officer of the unit to which the Reserve Officer is attached. These same sources also have the information regarding the types of duty or courses available.

Points to remember:

1. All applications should be submitted 6-8 weeks in advance of the anticipated dates of ACDUTRA. Courses with fixed dates and quotas are usually on a "first come, first served basis." Put

down a second choice in the event a quota is filled or you are not eligible for your first choice.

2. If the requested ACDUTRA requires a security clearance, one must have the required clearance before the orders can be cut. Clearance takes time, usually 3-4 months and longer if there has been past residence in a foreign country or if work has been performed for interests outside the United States. The command holding one's record will be able to give information in regard to the matter of clearance.

3. Ascertain the proper uniform required. Reserve Officers on ACDUTRA are to wear the proper uniform upon reporting for ACDUTRA and during the tour of ACDUTRA unless specifically directed otherwise. Failure to have and wear the proper uniform can prove to be a most embarrassing situation.

4. Find out whether government quarters are available or whether it will be necessary to make private arrangements. A call to the Administrative Officer of the activity to which one is to report will help solve this question. In the Washington, D.C. area government quarters are at a premium but the Reserve Division of BuMed will be happy to supply the names of motels and hotels. Make reservations well in advance of the anticipated ACDUTRA dates.

5. It is the present policy of the Bureau of Naval Personnel based on Article H-4202 (12) not to approve of ACDUTRA outside CONUS. This holds true even when the Reserve Officer states that he is willing to perform it at no expense to the government or will pay his travel cost.

As stated in the previous article, ACDUTRA can be a most rewarding and fruitful tour of duty. It is hoped that the foregoing information will help facilitate your future ACDUTRA planning.

## OCCUPATIONAL MEDICINE SECTION

### OFFICE SAFETY

Norvin C. Kiefer, MD MPH, New York, New York, JOM 9(11):560-566, Nov 1967.

Accidents killed 112,000 Americans in 1966 and caused 11 million disabling injuries. Work acci-

dents caused 13% of these deaths and about 20% of the disabilities.

Nevertheless, industry has established a commendable record of reduction of accidents at work.

Although accidents among office workers also can have fatal consequences, they seldom do. The absence of dramatic impact undoubtedly is a major factor in neglect of office safety efforts. If an office worker slips and crashes to the floor on his buttocks, the occurrence is likely to produce merriment and ridicule by fellow employees. There is nothing funny about a man whose hand has been severed by a press. One accident provokes laughter, the other horror. But if the office worker sustains a severe compression fracture of one or more lumbar vertebrae from his fall, is it he or the amputee who is likely to be absent from work for the longer period? Which one has the greater likelihood of becoming totally and permanently disabled?

Throughout American business and industry, many millions of people are engaged in office work. This number is growing because of the increases in our population and volume of business, but also because control of many machines by automation is converting a large number of former blue-collar workers to ones who wear white collars and sit on chairs before electronic control panels. They have escaped from the accident hazards of heavy machinery and, instead, now sustain fractures from falls off their chairs.

Our company has had an organized safety program since early in 1961. Initially these safety services were limited to the Home Office building, and this description shall be confined to these headquarters' services. The program is a Medical Department responsibility and is under the direct supervision of a trained company safety supervisor, who reports to the chief medical director. The safety supervisor is aided by an interdepartmental safety committee, of which he is the chairman.

Construction of this building was completed in August 1961. It was indeed fortunate that the safety program already existed at the time that the company moved to the new quarters, because a large number of new safety problems were encountered immediately. This had been anticipated and reasonably adequate preparations for countermeasures had been made.

At times it seemed as though most employees must be lying awake at night, plotting new ways to maim themselves at work. For example, the proper, safe location of electrical outlets under thousands of desks had been planned to the minutest detail,

and the movers carefully placed the desks in their new locations with precision. Then individual employees took upon themselves the moving of their desks, perhaps only a foot or two, but enough to convert safe floor arrangements into a maze of tripping hazards.

This is a continuing problem, but it is not the only cause of moving of desks. Cleaning employees often inadvertently bump into them, and a succession of slight nudges can in time produce a significant change in position. Another cause of desks moving that at first may be baffling to identify is the slight one-directional impact occurring when a desk drawer is closed. Hundreds of such acts can gradually move a desk several feet.

By the beginning of 1962, most of the problems created by new surroundings, equipment, and furnishings were under control. This article, therefore, is based on a 5-year experience thereafter, during 1962-1966. We are proud of our efforts but somewhat disappointed in our accomplishments. If some of the experiences seem shocking, or the record seems to be somewhat dismal, the reader is invited to examine his own company office safety records, if there are any. It is likely to be a chastening experience.

In the 5 years, there were 2,079 work accident injuries, of which 336 were disabling, with 2,748 days lost from work.

Because the subject of this paper is office safety, however, this discussion will be confined to those accidents that occurred in office work. There were 1,563 such accidents, of which 195 were disabling, with 1,158 days lost from work. These office accidents fell into the 6 commonly-used categories of accidents.

Falls caused 71 disabling office accidents and produced 642, or 55% of the lost days.

The second most important category of disabling accidents was that including strains, hernias, and the like. Such injuries are classed as accidents; there were 27 of them, with 246 days lost.

There were 16 caught "on or in or between" accidents, caused by file cabinet or desk drawers, doors, machines, and the like, with 97 days lost.

There were 17 "struck against" accidents in which the employee hit some part of his body against doors, drawers, desks, or other objects. Seventy-seven days were lost.

A total of 15 disabilities, with 47 days lost, occurred when employees were accidentally struck by



doors, other employees, elevator doors, motor carts, and other objects.

There were 49 disabling accidents from miscellaneous causes, with 49 days lost.

It is apparent that falls constituted the most important category of these disabling accidents. The most common falls were those occurring in hallways and work areas and caused by running, slipping, or tripping over wires, desk drawers, file cabinet drawers, or other objects. There were 34 of these.

The next most common falls were those from chairs. They caused 19 disabling accidents among all office employees. The remark about the computer operator falling from his chair was not facetious.

Next were falls on stairs, with 11 disabling accidents, and falls on escalators or at elevators caused 7 disabling accidents.

Merely presenting statistical data does not necessarily lead to drawing an adequate or accurate mental picture of the circumstances of accidents. For this reason, some typical accidents from our experience will be described.

Today nearly all of the unsafe conditions encountered in the building arise from bad housekeeping or from employees' unauthorized or inadvertent rearrangements of furniture and equipment. Floor electrical outlets are necessary for many desks, and each such desk must be positioned in such a manner as to form a full cover for the floor outlet. When the desk is moved, a metal outlet box about 3 in. high by 4 in. wide is exposed, and it provides a serious tripping hazard. Even more dangerous is the electrical cord extending for feet, even yards, from an outlet to a piece of electrical equipment on a desk, table, or elsewhere. It is less expensive to install a new floor outlet than to pay for an injury to an employee who trips and falls over a wire.

The total number of instances of tripping from such floor hazards is unknown, but they resulted in 3 disabling injuries with 42 days of work lost.

Bad housekeeping forms a continuing accident hazard. It takes continual vigilance on the part of supervisors to prevent employees from stacking boxes, stacks of papers, and other heavy objects on file cabinets, desks, and window ledges, or from placing such materials carelessly on shelving in such a manner that the slightest jar may result in

an avalanche falling on the offending employee or on a guiltless and unwary passerby.

All file cabinets must be bolted to each other or to the floor or wall. This was a major task following the move and, because it obviously would require weeks to complete, file cabinets temporarily were fastened together with heavy duty tape in such a manner that the drawers could be opened. In the process of taking the moving tags off furniture some employees, in their zeal, removed the tape from the file cabinets and a continuous round of replacing tape became necessary. Even today, unbolted file cabinets occasionally are found in departments in which some rearrangement of file cabinet location has been necessary. The danger from unbolted file cabinets arises when a heavy top drawer is extended to the maximum length and overbalances the closed bottom drawers, with the result that the entire file may topple over, pinning the file clerk under its heavy weight. This is a fertile source of accidents and serious injury but fortunately none were encountered here, largely because of the vigorous program of first taping and later bolting the cabinets.

More difficult, however, is the control of unsafe practices in which the employer converts standard equipment into dangerous instruments.

A female employee arrived quite early for work one morning and immediately went to the nearest ladies' toilet, probably to "put her face on." The lights were controlled by a key switch which the porter had not yet unlocked. In the dark, the employee resorted to that all-purpose tool of women, a bobby pin, which she inserted in a live electrical switch mechanism. Fortunately, she incurred only a small third-degree burn. She easily could have been killed by electrocution.

At first, it was assumed that this had to be a onetime event: certainly no other employee could be so foolhardy. In conversations during the ensuing weeks, however, the safety supervisor encountered 2 other employees—both males—who admitted attempting a similar maneuver, not with a bobby pin but a paper clip. The initial assumption then had to be changed: there must have been a number of other, similar instances that the medical department had not heard about, and never would.

It was expensive to change every key switch in a public area throughout this huge building but it was the only certain remedy, and it therefore was done. It was ironic that these switches, which were

installed as a safety measure, were converted, by employees, into an accident hazard.

There are many other unsafe practices, however, which may be carried out many times daily and are easily discernible—and correctable—by an alert supervisor.

File cabinet and desk drawers are provided with handles to be used in both opening and closing them. The employee who closes a file drawer with her fingers on the top edge is inviting having her fingers crushed between the front plate of the drawer and the cabinet. File and desk drawers have caused many injuries during this study. Five of these were disabling and included 1 fractured finger.

Each of 3 female employees pinched a breast in a file drawer she was closing, with, fortunately, only 1 day lost. It seems hardly necessary to point out that these injuries were extremely painful, not funny, to the employees involved.

The file, desk, or other drawer that is left open is an important and frequent cause of office accidents. If it is a top drawer, a head, face, or neck injury can occur when a stooping employee straightens up and bangs her head on the overhanging drawer. One employee sustained a fractured nose on an open drawer. If it is a lower drawer, the employee, or a passing employee, is likely to fall over it. File and desk drawer accidents caused 11 disabling injuries. Seldom are such accidents free of at least painful minor injuries and it is likely that severe injuries will be incurred.

Doors present another hazard. The modern, all-glass door or wall panel constitutes 1 type of danger, that of the person who, failing to recognize that it is not open space but glass ahead of him, walks into—or even through—the glass, frequently taking most of the impact on his face. Broken spectacles, a broken nose, or other facial injuries are likely consequences. Suitable “decals” or other devices must be installed immediately. There were a few such injuries in our building, but during the 5-year study there was only 1—an employee who walked into a glass door in the lobby, broke his nose, and was absent for 13 days.

A solid door presents another type of danger. There were 3 disabling injuries resulting from an employee opening a solid door and striking an employee approaching it from the opposite side. Employees should be taught to approach a door from the side away from the hinges, grasp the knob and start opening the door before assuming a position

in front of it. This should be done regardless of which way the door swings, because frequently the employee does not know or has forgotten which way each door he encounters swings.

Falls on stairs caused 11 disabling injuries with 95 days lost. Injuries included 4 fractured teeth, broken ribs, and a broken arm. Our employees are instructed to use the elevators, not the stairs, but this is difficult to control. The employee who walks up or down concrete steps with a package large enough to obscure his vision and requiring the use of both hands without leaving 1 free to grasp the hand rail is inviting disaster.

The coffee break has its own hazards, chiefly being scalded by a hot beverage or spilling any beverage on the floor for another employee to slip on and fall.

The employee who leans back in his chair that is equipped with casters, props his feet on the desk, closes his eyes and dreams, creatively, may be a valuable asset to company planning but is more likely to become an immediate casualty when his chair overturns and he falls backward, perhaps fracturing his skull on another desk or the floor. Most chair accidents occur, however, during more mundane activities. When a stenographer sits down on the front edge of a chair, the chair may scoot backward, leaving the stenographer to crash to the floor on her buttocks. Or, if she sits still further forward on the chair, it may tip forward, and the employee not only falls in the same position but may also be hit on the head by the back of the overturning chair.

In the 5-year period there were 19 disabling chair accidents, with 116 days lost.

Falls incurred by slipping were common. The greatest danger is produced by the running employee—the secretary running back to her desk to answer the telephone, the tardy employee running from the elevator in the morning, the employee joining a mass rush to the elevator at closing time, or the worker running for no apparent reason. One running female employee slipped and fell, and sustained a 113-lost-days fracture of her elbow.

The rate of injury accidents among male office-work employees was about the same as for their female counterparts. Their rate of disabling injuries was slightly higher, but their rate for total days lost was 2½–3 times as high as among female employees. This is a complex problem, which will require further study before conclusions can be drawn.



The disabling accident rate was highest in employees under 20. It dropped in the age group 20-29, and in most of the 5 study years was lowest at 30-39, 40-49, and 50-59, with a modest rise at 60-64 years.

Of practical significance is the observation that consistently the accidental injury rates among employees with less than 1 year of service were almost double those of employees with 1-4 years of service, and 3-4 times those of employees with 5 or more years of service. For disabling injuries, the difference was not as great between the less-than-1-year employees and the 1- to 4-year employees, but these 2 groups both had over twice as high a rate as employees with 5 or more years of service.

A total of 80% of all of the office accidents were caused by unsafe acts, and nearly 75% were judged to be solely the fault of the employee to whom the accident occurred.

### Conclusions

In planning and conducting an office safety program, there are at least 7 major points to consider:

1. A company safety program cannot succeed unless it has the whole-hearted backing of its top management. In our Home Office building periodic inspections are made of all departments. A detailed report of accident hazards in each is prepared and sent direct to the vice-president in charge of that department. A report of corrective measures taken is requested—and received.

2. Equally important is to instill a proper safety attitude in each level of supervision. The safety supervisor can only make periodic inspections. Prevention of accidents requires vigilance throughout every working day, and this is the responsibility of the supervisor. If he fails to carry out this function, accidents due to unsafe acts by his employees will continue, undiminished.

3. It is essential that safety instructions be promptly given to new employees. This is critically important in any company that, like ours, during a 2-month period each year employs over a thousand young people just graduated from high school. But it also is needed for all new employees, regardless of age.

4. Unfamiliar surroundings, new equipment, or altered work tasks increase the likelihood of accidents, even among veteran employees.

5. Mechanical hazards of heavy office equipment can be ascertained by careful, expert inspection and almost always can be eliminated or minimized,

although sometimes at substantial expense. The same precautions must be taken in connection with chemicals, dyes, inks and other supply items. Our purchasing division has cooperated well in these endeavors, and asks the safety supervisor for an opinion concerning inherent safety hazards before purchasing new equipment or supplies. Particular attention is paid to possible toxic, irritant, or flammable properties. Where hazards are unavoidable, specific instructions for careful handling are issued.

6. A manufacturer once said that he made his equipment foolproof but he couldn't make it idiot-proof. Perhaps the most frustrating office safety problem arises from careless or inept handling of simple office equipment. Employees continue to injure themselves with staplers, paper clips, correspondence paper, envelopes, and similar, presumably innocuous items. Or they bring in their own personal articles that may be highly flammable or otherwise dangerous.

7. The supervisor in office operations is likely to have the same lack of recognition of, or respect for, accident potentials, and the same limited mechanical aptitudes, that are found in the employees he—or as often, she—supervises. If a company could make a knowledgeable, tough, dedicated, deputy safety expert of every company supervisor, the office accident problem could be reduced to negligible size.

In the medical department each bureau director is required personally to investigate each accidental injury in his bureau and report to the chief medical director, in writing, why and how the accident occurred, who was at fault, and what steps have been taken—including instructions to the employees' supervisor—to prevent a recurrence.

### CERVICAL TRACTION IN INDUSTRY

*Kenneth H. Messner, MD, Boston, Mass.*

One of the recurring clinical problems seen at the Quonset Point Naval Air Station Civilian Dispensary is cervical arthritis. The combination of age (the civilian employee population has a median age of 43 years, Rhode Island statewide has a median employee age of 41.6 years) and the physical activity involved in repairing and modifying military aircraft probably contribute to the frequent diagnosis of cervical arthritis made within this federal employee group. The therapy of these individuals has brought problems not only in properly placing them or modifying their environment but also in administratively handling their sick leave



applications when intermittent cervical traction was used while the employees were working in a limited duty status. In some instances a half day of sick leave had to be consumed several times weekly while intermittent cervical traction was being applied by the attending physician. The several cases of cervical arthritis in retired military personnel demanded the complete responsibility for their care, and this usually resulted in trips to Newport Naval Hospital or the Quonset Point Station Hospital, both of which consumed time and removed the man from the immediate area of employment. Accordingly, cervical traction gear was procured and the service was offered only to those patients, retired military and civilian alike, whose attending physician so recommended this form of therapy for cervical arthritis. Due to time and space limitations it was decided to use bed traction with moderately heavy weights ranging from 10 to 25 pounds for one half hour periods. No physical therapy preceding the application of the weights was used.

In all instances considerable to complete relief of symptoms was obtained within three to four weeks of daily traction for one half hour periods. This result is not surprising, but the fact that these men were kept productive on the job while obtaining adequate physical therapy is a point to be considered by all industries, military and civilian, with occupational health departments. Most of the men treated at this facility were able to complete all their daily assignments and obtain their period of traction. The actual time away from the work area averaged forty-five minutes daily.

Intermittant cervical traction has proven to be a safe, economical, effective service offered to an industrial population for a chronic disabling condition. The savings in sick leave and time lost from the job area has been considerable in addition to

providing better control for the industrial physician over the patient, his working status and job assignment.

Commensurate with the spirit of the Statement by the President to the Cabinet on New Guidelines for Federal Employee Health Service Programs of 21 June 1965, naval installations with industrial medical officers should consider adding cervical traction to their program for reducing needless sick leave and promoting increased productivity through better health care and control of the individual employee.

#### MESSAGE TO MEDICAL OFFICERS REGARDING OCCUPATIONAL HEALTH

The Navy has a continuing need for the services of medical officers trained in the specialty of Occupational Health. The occupational health needs of a Navy and Marine Corps of over one million military personnel and 375,000 civilian employees represent a challenge to the Medical Corps and afford an opportunity for an interesting and rewarding career for those medical officers trained in this specialty. Individuals thus trained may look forward to varied assignments at Naval industrial establishments at levels of responsibility commensurate with their training and experience. Board certification requires two years of academic instruction leading to the Master of Public Health degree (or other degree depending on the institution) and a third year of in-plant residency training. Successful applicants may receive their training at any approved university providing such instruction.

Medical officers interested in receiving occupational health training should apply in accordance with BUMEDINST 1520.10C or write for further information to the Chief, Bureau of Medicine and Surgery (Code 73), Navy Department, Washington, D.C. 20390.

## EDITOR'S SECTION

### ACUTE GLOMERULONEPHRITIS

The possibility of preventing one of the most common kidney diseases in children, acute glomerulonephritis, is indicated by the results of the first half of a study of a *nephritis epidemic in South Trinidad*. The study is being performed by Northwestern University, in cooperation with the Government of Trinidad and Tobago, under a contract from the Public Health Service's National Cen-

ter for Chronic Disease Control, and its first report appears in a current issue of the *New England Journal of Medicine*.

Recurrent nephritis epidemics in South Trinidad led the Center's Kidney Disease Control Program to arrange for the study in order to clarify the relationship between this serious kidney ailment and streptococcal infections of the skin and throat, which precede glomerulonephritis in the majority

of patients. The project is also intended to shed needed light on the problem of preventing this type of kidney disease. Because there is no effective treatment for this disease once it is established, prevention and early detection are all-important in glomerulonephritis.

Although the connection between streptococcal skin sores and glomerulonephritis first attracted notice in 1939, it was not until a 1955 epidemic of the kidney disease occurred at the Red Lake, Minnesota, Indian Reservation that the association of the two diseases was fully recognized. The Red Lake and Trinidad epidemics were similar in many ways. Both were limited to children under ten and were characterized by the presence of skin sores in the individuals affected. Personal hygiene, adequate sanitation facilities, and effective insect control were generally lacking at both locations.

While the majority of the stricken children recover, one to two percent have died during the peak stage of their kidney disease or soon afterward. Others who survive the acute phase or never have overt symptoms of the disease may develop chronic kidney disease, progressing to kidney failure and death.

As the *New England Journal* points out, in an editorial occasioned by the study report, the similarity of the epidemic in Trinidad and the earlier Red Lake outbreak presents a unique opportunity to better understand precisely what preventive measures are required to cope with the problem.

Massive penicillin treatment in the Red Lake epidemic promptly halted the streptococcal infections and aborted the nephritis epidemic. Although the much larger population in South Trinidad would make a similar penicillin treatment program there impractical, a less extensive penicillin program aimed at only the most susceptible age groups might limit the spread of infections. Certainly, according to the editorial, the long term control of this problem is ultimately dependent on public health measures such as improved sanitation, personal hygiene and insect control.

The report, by Dr. Theo Poon-King *et al.*, appears in the *New England Journal of Medicine*, 277: 728-733, 1967.—USDHEW, Nov 15, 1967.

### THE FAILING HEART

Scientists of the Public Health Service's National Heart Institute report that the failing heart converts chemical energy to mechanical work at least as efficiently as does the normal heart. Previously,

the fundamental biochemical defect in heart failure had been attributed by many to a defect in energy utilization. This defect is now thought to be either in the contractile proteins actin and myosin, which are the basic elements of contraction of the heart muscle fibril, or in the process of excitation-contraction coupling, by which the heart muscle is activated. In excitation-contraction coupling, calcium within the muscle is released and in turn causes a release of energy for the heart's contractions. This energy release causes the muscle to contract.

In order to determine whether there was any defect in energy transfer in the failing heart, Dr. Peter E. Pool and co-workers at National Heart Institute studied the direct conversion of chemical energy to mechanical work in right ventricular papillary muscles from normal cats and cats with experimental right ventricular failure.

Papillary muscles are the muscular eminences in the ventricles of the heart which, in combination with the atrioventricular tendons cause the cardiac valves to open and close. These muscles were used in this study because they are of a convenient size and also because all of their fibers are parallel, making it easy to measure the amount of work done in pulling in one direction.

The papillary muscles were treated to prevent the production of ATP from the metabolism of food stuffs. The muscles were then stimulated to perform work by pulling against a load, and the amount of work was measured. They were then frozen and analyzed to determine the amount of ATP present. This gave a measurement of the amount of energy burned. The investigators found that failing heart muscles and normal heart muscles used the same amount of ATP energy per unit of work. This indicates that the failing heart converts chemical energy to mechanical work as efficiently as the normal heart.

Since the biochemical defect in heart failure is not in energy utilization, the National Heart Institute investigators postulate that the defect must be either in the contractile proteins or in excitation-contraction coupling.

These results were reported at the 40th Scientific Sessions of the American Heart Association in San Francisco by Drs. Peter E. Pool, Brian M. Chandler, James F. Spann, Edmund H. Sonnenblick and Eugene Braunwald of the Public Health Service's National Heart Institute.—USDHEW, December 1967.

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—Editor

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